mental scores or work productivity. Greater increases in pharmacy costs for the DTM cohort were partially offset by smaller increases in medical costs, resulting in similar total health care costs for DTM patients compared with controls.

ME2

THE EFFECT OF MEDICARE PART D PRESCRIPTION DRUG COVERAGE GAP ON MEDICATION ADHERENCE

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OBJECTIVES: To investigate the impact on medication adherence for patients with common chronic conditions who reach the Medicare Part D coverage gap versus those who do not. The study is unique because it included characteristics of Medicare Part-D enrollees that are typically not available in administrative databases. **METHODS:** A survey based on the Seniors' Prescription Coverage, Use and Spending Survey and the Brief Medication Questionnaire was distributed to elderly persons seeking care at the pharmacies within the University of Arkansas for Medical Sciences Advanced Practice Network. Patients recruited were ≥65 years, enrolled in Medicare Part D in 2007 or 2008, and had the following conditions: hypertension, hyperlipidemia, diabetes, asthma/COPD, or depression. Adherence was a composite measure based on responses to several questions asking if subjects skipped doses, took smaller doses or decided to not fill at all. Logistic regression was run to evaluate the impact of being in coverage gap on medication adherence, adjusting for age, sex, race, income, and education levels. **RESULTS:** A total of 152 subjects (62% female, 44.1% greater than 75 years of age, and 92.7% white) completed the survey. A total of 44.7% reached coverage gap in 2007 or 2008 and 31.6% reported non-adherent. 45.4% had monthly income of $2000 or less and 34.2 had no college education. Subjects in the coverage gap were twice as likely to be non-adherent to medication regimen as compared to those not in the gap (adjusted odds ratio = 2.07, p-value = 0.051). **CONCLUSIONS:** There is likely significant impact of falling in the coverage gap on medication adherence for the elderly, which may have adverse health consequences. Decision makers ought to be cognizant of these implications.

ME3

IMPACT OF COST SHARING ON TREATMENT AUGMENTATION IN PATIENTS WITH DEPRESSION

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OBJECTIVES: Patients with depression may not respond to first-line antidepressant (AD) therapy. Treatment options include changing from one AD to another and augmenting AD treatment with another concurrent AD, a stimulant, a mood stabilizer, or a second generation antipsychotic (SGA). While treatment decisions are primarily based on clinical considerations, they may also be influenced by patient cost-sharing. This study examines the relationship between cost-sharing and the use of augmentation among depressed patients who are already filling prescriptions for AD treatment. **METHODS:** Patients aged 18–64 in employer-sponsored plans with a diagnosis of depression and at least one antidepressant prescription were found in the 2004–2008 MarketScan Database. Twelve months of continuous medical and prescription coverage were required before and after the initial antidepressant prescription. Patients with certain psychiatric diagnoses (e.g., schizophrenia) were excluded, resulting in a sample of 48,865 patients. Logistic regression models estimated the probability of augmentation within 12 months as a function of a plan-level cost-sharing index for brand and generic antidepressant and augmentation medications, controlling for demographic and clinical characteristics. Results are reported as odds ratios (OR) and 95% confidence intervals (CI). **RESULTS:** A $10 increase in the cost-sharing index for all augmentation classes was associated with a 5% decrease in the odds of any augmentation (OR 0.947, 95% CI 0.916–0.979, N = 48,795). A $10 increase in the cost-sharing index for antidepressants was associated with a 6% decrease in the odds of augmentation with a second antidepressant (OR 0.939, 95% CI 0.902–0.977, N = 47,269). **CONCLUSIONS:** Prescription drug cost-sharing appears to influence the decision to augment AD treatment. Financial barriers may prevent patients from receiving additional care.

ME4

THE IMPACT OF MEDICARE PART D ON HEALTH CARE UTILIZATION AND HEALTH OF THE MEDICARE BENEFICIARIES

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OBJECTIVES: To examine, using nationally representative data, the impact of Medicare Part D on out-of-pocket-costs, emergency room visits, hospitalization, and general health among civilian non-institutionalized Medicare beneficiaries. **METHODS:** The primary data were from the Medical Expenditure Panel Survey (MEPS) panel 10 data, which included Medicare beneficiaries aged 65 and older in 2005. Near elderly respondents in MEPS (aged 55 to 63 years old) in 2005 served as control subjects. Raw and adjusted difference-in-differences were used to identify the effects of Medicare Part D on Medicare beneficiaries in terms of out-of-pocket costs, emergency room visits, hospitalization, and general health according to a preference-based summary score (SF-12 based utility scores). **RESULTS:** Controlling for secular trends, Medicare Part D prescription drug benefit resulted in a 22% (95% CI: 7%–37%) reduction in out-of-pocket costs among Medicare beneficiaries ($p = 0.0020$). However, the Medicare Part D benefit did not significantly impact emergency room visits (OR = 1.15, 95%CI: 0.59–1.71), hospitalization (OR = 1.64, 95% CI: 0.68–2.60), or overall health ($\beta = -0.0057$, 95% CI: −0.0210–0.0096) among Medicare beneficiaries compared to controls. **CONCLUSIONS:** In the first year following the implementation of Medicare Part D, out-of-pocket costs for prescription drugs were reduced among Medicare beneficiaries. However, Medicare Part D was not associated with improved health outcomes of Medicare beneficiaries as measured by reductions in emergency room visits and hospitalization and improvement in their health utility score. Further research should follow Medicare beneficiaries for a longer period of time after its implementation or focus on beneficiaries with diseases that might be more sensitive to Medicare Part D.

PODIUM SESSION II: STUDIES DEALING WITH SELECTION BIAS

SB1

EXPENDITURE OF DISEASE MODIFYING ANTI-RHEUMATOID TREATMENT—LAGGED TREATMENTS AS INSTRUMENTAL VARIABLES IN PANEL DATA

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OBJECTIVES: To compare the incremental medical expenditure associated with alternative disease modifying anti-rheumatoid drug (DMARDs) choices in Rheumatoid Arthritis. **METHODS:** Retrospective cohorts were constructed from California Medicaid paid insurance claims between January 1, 1998 to December 31, 2005. Non-overlapping monthly panels were created from pharmacy claims for biologic (adalimumab and etanercept) and standard (methotrexate, lefluonomide, hydroxychloroquine and sulfasalazine) DMARDs. Final sample included 59,788 observations on 7,025 patients. Covariates included age, gender, race, location of beneficiary's county in either Northern or Southern California, population density in beneficiaries county, exclusive fee-for-service reimbursement used in beneficiary's county, Medicare and Medicaid dual eligibility, Charlson comorbidities index excluding Rheumatoid arthritis, and expenditures associated with pharmacy, out-patient, inpatient, inpatient-MD, LTC, and ER visits in the 3-months prior to treatment. We compared parameter estimates between naïve fixed effects (FE) and instrumental variables based fixed effects (IV-FE) panel data models. First lag of the observed treatment served as the instruments for the endogenous variables in IV-FE models to mitigate time-varying endogeneity. The primary dependant variable was total monthly expenditure. Secondary analysis included monthly expenditures associated with pharmacy, out-patient, inpatient, inpatient-MD, LTC, and ER visits. **RESULTS:** Based on the FE model, as compared to methotrexate, incremental monthly total expenditure associated with adalimumab ($1623.4, $p < 0.001$), etanercept ($1185.3, $p < 0.001$) and leflunomide ($467.3, $p < 0.001$) was significantly higher. Based on the IV-FE model, total expenditure associated with adalimumab ($2129.9, $p < 0.001$), etanercept ($1604.1, $p < 0.001$) and leflunomide ($686.8, $p < 0.001$) exhibited significant increase in magnitude of the parameter estimates, again with baseline as methotrexate. Under identification test based on Anderson's canonical correlation LM statistic, strongly rejected the null hypothesis in all the IV-FE models. **CONCLUSIONS:** The incremental acquisition cost associated with adalimumab, etanercept and leflunomide may not be offset by commensurate reductions in routine and catastrophic resource utilization in the California Medicaid population.

SB2

COMPARING BINARY PROPENSITY SCORE ANALYSIS WITH MULTIPLE PROPENSITY SCORE APPROACH AMONG PATIENTS WITH CHRONIC HEART FAILURE

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OBJECTIVES: Propensity scores (PS) are often used with the binary treatments. However, in day to day practice multiple treatment settings are experienced rather than binary treatments. Therefore extension of binary PS analysis to multiple PS will add to the empirical knowledge of use of PS. We compared binary PS analysis with multiple PS approach by examining clinical effectiveness in patients with Chronic Heart Failure (CHF). **METHODS:** The study was a retrospective analysis of a national cohort of patients diagnosed with CHF identified from the Department of Veterans Affairs electronic medical records system. PS analysis (binary and multiple) was used to balance 47 baseline patient characteristics between the different Angiotensin Converting Enzyme Inhibitors (ACEIs). For multiple PS we used multinomial logistic regression and for binary PS we split our cohort into separate models. Effect of different ACEIs on time to death was assessed using a multiple PS weighted Cox proportional hazard model and three separate binary PS weighted Cox proportional hazard models. Captopril was used as reference in all models. The statistical significance of effect of individual ACEIs on mortality was compared between the two propensity approaches. **RESULTS:** For binary propensity approach the adjusted hazards ratio from three different PS-weighted Cox models were 1.003 (95% CI: 0.724–1.390) for enalapril, 0.740 (95% CI: 0.688–0.796) for fosinopril and 0.823 (95% CI: 0.770–0.879) for lisinopril compared with captopril. For multiple propensity approach the adjusted hazards ratio were 1.033 (95% CI 0.739–1.445) for enalapril, 0.738 (95% CI: 0.685–0.796) for fosinopril, and 0.819 (95% CI: 0.767–0.875) for lisinopril. **CONCLUSIONS:** We found the 2 propensity approaches produced similar

estimates of the effects of individual ACEIs on mortality. Multiple PS may be used more often if no information needed to predict outcomes is lost from sub sampling.

SB3

COMPARISON OF DIFFERENT PROPENSITY SCORE MATCHING METHODS IN ELDERLY ANTIPSYCHOTIC USERS

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OBJECTIVES: Various propensity score matching techniques are used in observational studies to reduce selection and confounding bias. The purpose of this study was to evaluate the four most popularly used matching methods namely Mahalanobis metric matching within calipers of propensity scores, caliper matching with and without replacement and greedy matching for making elderly antipsychotic users comparable. **METHODS:** IMS LifeLink™ Claims were utilized to identify elderly patients using atypical and typical antipsychotics. Eighty covariates including demographics, hospitalization, co-morbidities and co-medications were used to match typical and atypical antipsychotic users using propensity scores matching. Propensity matching methods were evaluated on the basis of following criteria: (1) Number of variables which remains significant after matching using t-test and chi-square; (2) Percentage bias reduction for the variables which remained significant after matching; (3) Mean difference in propensity scores as a percentage of average standard deviation (SD); and (4) Density estimates of the propensity scores of the two groups using the Kolmogorov-Smirnov test. **RESULTS:** The four matching methods reduced bias by making two groups comparable. However greedy matching yielded the best results when the four criteria were applied. Only 5 explanatory variables remained significant after greedy matching compared to 36, 43 and 9 with Mahalanobis metric matching, and caliper matching with and without replacement, respectively. More than 90% bias reduction was obtained through all the matching methods. Mean difference as a percentage of the average SD was 0% with greedy and caliper matching with replacement and these were the only techniques that produced propensity scores densities with insignificant differences. **CONCLUSIONS:** The greedy matching technique was found to be efficient in matching different classes of antipsychotic users. Although the efficiency of matching methods could differ based on the study sample and availability of covariates, *a priori* criteria can be useful in selecting the most appropriate matching technique.

SB4

DEALING WITH SELECTION BIAS IN NONLINEAR SETTINGS: A CASE OF COMPARATIVE EFFECTIVENESS OF STATIN PLUS FIBRATE COMBINATION THERAPY VERSUS STATIN MONOTHERAPY IN TYPE II DIABETES

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OBJECTIVES: To estimate the effectiveness of statin+fibrate combination-therapy versus statin-monotherapy on cardiovascular disease(CVD) occurrence in subjects with type II diabetes in a managed care setting using appropriate econometric models dealing with selection bias in nonlinear settings. **METHODS:** Combination-therapy-group and monotherapy-group were identified among subjects with type II diabetes with two-years intake period(7/1/2002–6/30/2004) and three-years follow-up using administrative claims from a US health plan covering four million lives. Outcomes measure was CVD-occurrence. A univariate-probit model was developed to evaluate adjusted CVD-risk difference between groups. To control for selection bias, we used propensity score(PS) and instrumental variable(IV) method. To deal with nonlinear outcomes, we built two-stage-probit model with IV method using two-stage-residual-inclusion estimation. We used physician prescribing preference as the instrument. To test the validity of the instrument, we tested for the correlation between the instrument and treatment indicator using standard t-test. To check whether it is valid to exclude the instrument from the main equation, Wald-test was performed. Stock-and-Yogo test was used to check the weak instrument issue. To test the endogeneity of treatment indicator, we performed Hausman-test. **RESULTS:** Adjusting for age, gender, prior-CVD, CVD-related pharmacy-costs, Elixhauser-comorbidity, and diabetes with complication, combination-therapy-group experienced 9.1% less CVD compared with monotherapy-group at the mean of covariates($P = 0.008$). The results from probit and PS model were similar. For the IV model, specification-tests indicated that the validity of the instrument was satisfied. However, Hausman-test implied that treatment-indicator was not endogenous($p = 0.172$). **CONCLUSIONS:** To deal with nonlinearity issues when using IV method, we employed two-stage residual-inclusion estimation. Since we failed to identify selection bias which may be due to untestable assumptions and treatment effect heterogeneity, a univariate-probit model or PS model was used to draw conclusions. In diabetics after adjusting for known baseline differences, CVD-risk was significantly lower among subjects with statin+fibrate combination-therapy compared with those with statin-monotherapy.

PODIUM SESSION II: HEALTH CARE TRENDS

TR1

THE EFFECT OF GENERIC DRUG ENTRY ON U.S. MEDICAID EXPENDITURES: 1991–2008

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OBJECTIVES: After the patent expires for a branded pharmaceutical, generic drug companies sell bioequivalent versions of the drug, leading to lower prices and reduced expenditures for payers. The objectives of this study were to 1) predict the number of generic-company entrants in the market, and, 2) determine the trend in drug price post-entry based on drug, market, and firm characteristics. **METHODS:** Using the national summary file of Medicaid outpatient drug utilization maintained by the Centers for Medicare and Medicaid Services, quarterly utilization and expenditure data from 1991–2008 were extracted for 40 drugs that experienced initial generic entry between 1992 and 2004. Generic relative price (GRP) was constructed as reimbursement per unit for a specific firm and quarter divided by average reimbursement per unit over the year before entry. Least-squares regression models were estimated on the panel data to explain number of entrants, GRP, and average GRP across firms (AGRP). **RESULTS:** After patent expiration, the number of generic-firm entrants ranged from 1 to 25. Significant ($p < 0.0001$) predictors for number of entrants included pre-entry market size, market growth, number of quarters since entry, and administration form (oral, injectable, or topical). The number of firms had a statistically significant ($p < 0.0001$), nonlinear negative effect on GRP and AGRP. With the addition of one more generic firm, GRP is expected to fall by 0.018; AGRP is expected to fall by 0.053. High demand, as indicated by high post-entry expenditures, had a statistically significant ($p < 0.0001$) positive effect on both GRP and AGRP. Many of the firm-specific effects were significant ($p < 0.0001$). **CONCLUSIONS:** Medicaid can generally look forward to cost savings following generic entry. However, a small initial market size or a drop in demand following entry prohibits Medicaid from obtaining cost relief. Differences in pricing strategies across firms were indicated by the variation in GRP across manufacturers.

TR2

RECENT TRENDS IN EMPLOYER HEALTH CARE SPENDING BY DISEASE

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OBJECTIVES: Efforts to "bend the cost curve" in US health care need to be informed by a differentiated view of health care spending by disease. We highlight the importance of particular diseases based on level and rate of growth of spending. **METHODS:** National health care spending by employers for all services and for prescription drugs was estimated using claims data from employer sponsored health plans from 2004 and 2008. Data were projected using sampling weights derived from the Medical Expenditure Panel Survey and trends in spending were calculated as compound annual growth rates (CAGR). Claims were assigned to disease-specific episodes using the Thomson Reuters Medical Episode Grouper (MEG). **RESULTS:** Annual spending data were analyzed for 122 employers with 11.5 million covered lives in 2004 and 143 employers with 15.6 million covered lives in 2008. Overall spending grew at 8.6% per annum while prescription drug spending grew at 10.8%. Musculoskeletal conditions were the most important body system, representing 18% of all spending and growing at 11% per year, well above average. Several specific conditions had total spending growth rates of 15%, including osteoarthritis of the spine, multiple sclerosis, and prostate cancer. Preventive health services also grew at 15%. The single disease with the largest total spending, angina pectoris, grew at less than 1% per year. Drug spending grew the fastest for Crohn's disease (25%), epilepsy (23%), and multiple sclerosis (19%). Spending for type 2 diabetes drugs was particularly important, as it represented 11% of all drug spending and grew at 17% per year, well above average. **CONCLUSIONS:** Major drivers of recent growth in employer health care spending are conditions related to obesity, including musculoskeletal and endocrine conditions. The highest rates of drug spending were observed in conditions where biologic therapies are becoming standard of care.

TR3

TIME-RELEASE LAUNCH IN RELATION TO GENERIC LAUNCH: CASES

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OBJECTIVES: While generic drug use has become more common with the availability of generic alternatives to the many high volume branded products, the rate at which generic drugs have displaced branded counterparts is not well understood, particularly when time-release (TR) brands are introduced within a similar timeframe. We examined the uptake of generic drugs with respect to products and classes in conjunction with the uptake of time-release formulations of branded products to determine the impact of generic uptake on branded drugs, particularly when a branded time-release formulation is launched prior to generic competition. **METHODS:** SSRIs, atypical antipsychotics, nonbenzodiazepines as well as azythromycin were selected as case classes and products. From 1995 to 2009 the volume of prescriptions were collected monthly using SDI's VONA databases and grouped according to branded and generic sales by active molecule. **RESULTS:** Among SSRIs, brands that launched TR branded products at least one-year prior to the launch of the original formulation generic, such as paroxetine, saw less erosion of the total brand than those with TR launch less than one year or no TR launch. Similarly, among nonbenzodiazepines, early launch of TR